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Angler Survey of an Experimental Recreational Bull Trout Fishery for Hungry Horse Reservoir and South Fork Flathead River, Montana for the 2019 and 2020 Seasons

Prepared by:

Leo Rosenthal, Fisheries Biologist
And
Scott Hawxhurst, Fisheries Technician

Montana Fish, Wildlife & Parks
490 N. Meridian Road
Kalispell, Montana 59901

Montana Fish, Wildlife & Parks

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The authors would like to thank the R-1 support staff for their efforts in processing bull trout catch card applications and for informing anglers of the proper catch card procedures. Additionally, FWP employees Corinne Selby and Cedar League were instrumental to this project and their efforts in mailing surveys and entering data were greatly appreciated.

SUMMARY

In 2004, Montana Fish, Wildlife & Parks (FWP) applied to the U.S. Fish and Wildlife Service (USFWS) for authorization to allow a limited sport fishing season for bull trout (*Salvelinus confluentus*) under Section 10(a)(1)(A) of the Endangered Species Act for fisheries deemed to have reached recovery goals. The USFWS permitted fishing for bull trout on Hungry Horse Reservoir (HHR), South Fork Flathead River (SFF) and Lake Koocanusa (LK) per the regulations proposed by FWP, which allowed angler harvest of up to 300 fish from HHR and catch and release but no possession from SFF. The permit also requires a bull trout permit and catch card system, angler survey and development of educational information pertaining to these new fisheries.

The 2019 and 2020 angling seasons represent the 16th and 17th years of permitted fishing for bull trout in HHR and SFF. Survey results produced an estimated 751 days of bull trout angling on HHR in 2019 and 632 days in 2020. Similarly, anglers fished an estimated 1,610 days on SFF in 2019 and 1,565 days in 2020. Consistent with the previous report (Rosenthal and Hawxhurst 2020), recent data reveal that anglers continue to use the SFF more than HHR to pursue angling for bull trout. In 2019 an estimated 427 bull trout were caught in HHR and 351 were caught in 2020. Of the estimated catch, 46 bull trout were harvested in 2019 and 56 in 2020. In the SFF, an estimated 552 bull trout were caught and released by anglers in 2019 and 437 were estimated in 2020. Estimated bull trout catch in both HHR and SFF was less than the previous reporting period. Estimated bull trout catch in HHR has continued to decline with the reduced angling pressure on the reservoir. While the number of bull trout caught and released in both HHR and SFF has increased since the inception of the permitted fishery, estimated take (including estimated mortality from released fish) continues to be below the USFWS authorized limit of 300 bull trout. The increasing trend in angler pressure and subsequent increase in numbers of bull trout being caught and released in the SFF continues to be closely monitored to ensure that mortality does not exceed permitted levels. The population trend will also be closely monitored to ensure that adverse effects are avoided.

INTRODUCTION

We conducted an angler mail survey for the recreational bull trout fisheries on Hungry Horse Reservoir (HHR) and South Fork Flathead River (SFF) for the 2019 and 2020 seasons. These fisheries are regulated by Montana Fish, Wildlife & Parks (FWP) under special permit by the U.S. Fish and Wildlife Service (USFWS) due to listing of bull trout as a "threatened species" under the Endangered Species Act in 1998.

BACKGROUND

Bull trout were listed as threatened under the Endangered Species Act in 1998. At the time of listing, sport fishing for bull trout was continued only in Swan Lake because of stable populations.

In 2004 the USFWS authorized sport fishing for bull trout on HHR, SFF and Lake Koocanusa (LK) (Rumsey et al. 2005). This activity was intended to benefit the species by measuring the effects of restoring recreational fishing and by increasing public support for management of bull trout populations in the identified water bodies, which were deemed to have reached recovery goals. Public support is essential for restoration of bull trout habitat and for other management activities that will increase the distribution and abundance of bull trout populations throughout the state. Providing recreational and harvest fisheries for bull trout increases public appreciation of the species and support for restoration programs.

METHODS

Conditions of the USFWS special permit (TE-077533) for new bull trout fisheries contained specific items agreed upon by both USFWS and FWP. Part of the conditions called for the development and use of a harvest catch card. Also required was a formal survey of anglers participating in these experimental bull trout fisheries. Educational materials were also developed to explain catch card use, bull trout identification, seasons, limits, and regulations pertinent to each fishery and bull trout conservation measures.

Bull Trout Permit Application

Consistent with previous years, bull trout permit application forms were made available through the Region-1 FWP office and over FWP's web site. However, since 2016 anglers were also able to complete the application and obtain a catch card at the US Forest Service Spotted Bear Ranger Station in response to requests from anglers and outfitters. The application required the angler's name, address, automated licensing system (ALS) number and permit area (waters) that they chose to fish. When the experimental fishery began in 2004, anglers applied for one catch card with validations for any combination of the three waters (HHR, SFF, and LK). In 2007 anglers were given the choice of two catch cards. Separate catch cards were issued for HHR/SFF and LK. However, anglers still had the option of obtaining both catch cards. Beginning in 2009, anglers were only allowed to obtain one catch card, and had to choose between the two drainages. This rule has remained unchanged since 2009. There continues to be no charge for the bull trout catch card.

Bull Trout Catch Card

After processing a completed application, a numbered catch card was issued to each angler. The catch cards provide general instructions for anglers fishing for bull trout on HHR and SFF. The cards required entry of the catch zone, fish length, month and day of catch for each fish harvested or released in HHR and for each fish caught and released in SFF.

Upon landing a bull trout, an angler must either immediately release or legally harvest the fish. Immediately upon harvesting a bull trout from HHR, anglers must record the required information in ballpoint pen and notch out a triangle on the line for each fish.

Bull Trout Angler Mail Survey

Similar to previous seasons, we felt we could obtain more thorough and accurate estimates by conducting a survey of catch card holders (Hensler et al. 2005; Rumsey et al. 2005; Hensler and Benson 2006; Rosenthal and Hensler 2008; Rosenthal 2009; Rosenthal 2010; Rosenthal 2011; Rosenthal and Hawxhurst 2014; Rosenthal and Hawxhurst 2015; Rosenthal and Hawxhurst 2018; Rosenthal and Hawxhurst 2020) rather than rely solely on catch card returns. The survey was sent to all individuals who obtained a catch card, contrasting what was done in 2007 when the survey was sent only to anglers who did not return their catch cards by a certain date. The survey asked anglers to enter the information recorded on their catch card including whether the angler fished for bull trout or not and the number of days fished per water (HHR and SFF). The survey also requested specific catch card information pertaining to harvested or released fish by date, zone and size of fish. Beginning in 2009, anglers were asked to keep their catch card until they received the survey. This allowed anglers to simply transfer their catch card data to the survey, leading to less duplicate and erroneous data.

RESULTS

Bull Trout Angler Mail Survey

Catch cards were issued to 1,301 anglers in 2019 and 1,042 anglers in 2020. Individual surveys were sent to all catch card holders. In instances where multiple family members were issued catch cards, all surveys were sent in one envelope to decrease department expenses. The surveys were sent out in early winter, as the catch and release season on SFF had already closed and angling on HHR was likely done for the season. Similar to previous years, we sent out a reminder mailing to anglers that had not responded by a certain date. By early July few surveys were still being returned and personnel in Bozeman began entering the survey data. Consistent with previous years, survey return rates were high with ~60% of anglers responding in both years surveyed.

Angler Participation

The number of catch cards issued for the HHR/SFF experimental fishery has increased since 2011 (Figure 1). This increase could be the result of more restrictive regulations in Lake Koocanusa redirecting angler effort to HHR and SFF but could also simply be indicative of an

increasing Flathead Valley population and increased tourism to the area. Additionally, starting in 2016 anglers were able to obtain catch cards at Spotted Bear Ranger Station and this may have led to elevated numbers of applications.

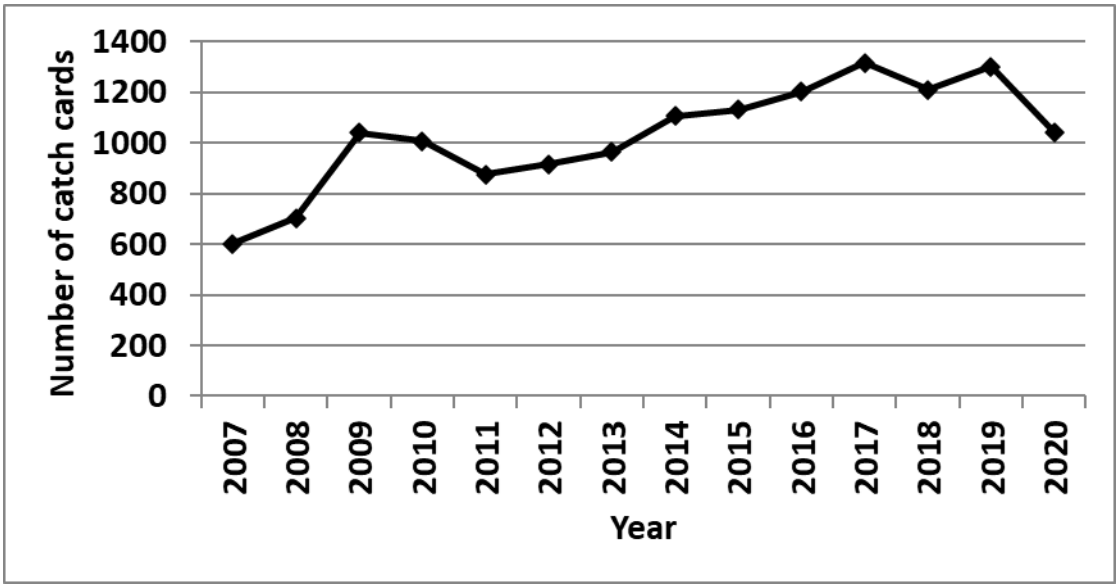

Figure 1: Number of catch cards issued for HHR/SFF 2007-2020.

Angler Demographics

Consistent with previous years, the majority (71% in 2019 and 75% in 2020) of permitted bull trout anglers for HHR/SFF were Montana residents. Non-resident anglers for HHR/SFF resided in 46 other states. Surprisingly few anglers from neighboring states (Idaho (33), Washington (51), Wyoming (7), North (2) and South Dakota (5)) and Canadian provinces (only Alberta) participated in this fishery during the 2019-2020 seasons.

Fishing Pressure Estimates

Survey results revealed that bull trout anglers fished 440 days on HHR in 2019 and 337 days in 2020 during the period surveyed (Table 1). Similarly, anglers fished 943 days on SFF in 2019 and 8357 in 2020. To estimate total bull trout angling pressure, we used the number of anglers and angler days reported by survey respondents who fished for bull trout (Hensler et al. 2005; Rumsey et al. 2005; Hensler and Benson 2006; Rosenthal and Hensler 2008; Rosenthal 2009; Rosenthal 2010; Rosenthal 2011; Rosenthal and Hawxhurst 2014; Rosenthal and Hawxhurst 2015; Rosenthal and Hawxhurst 2020). For non-responding anglers we assumed the same proportion fished for bull trout with the same effort (Table 1). Estimated pressure for HHR has been declining in recent years, with the 2020 estimated pressure of 632 days being the lowest on record, and 40% lower than the long-term average of 1,067 angler days (Figure 2). However, angler pressure in the SFF has been increasing since 2011. This increase in angler pressure has resulted in the SFF becoming the predominant location for bull trout fishing in the drainage.

Anglers fished an estimated 1,610 days in the SFF in 2019 and 1,565 days in 2020. This represents a nearly 150% increase since 2011.

Table 1: Bull trout season pressure estimates extrapolated from angler survey results for HHR and SFF 2004-2020.

	Angler Days of Fishing Pressure			
	Hungry Horse Reservoir		South Fork Flathead	
Year	From Survey	Estimated	From Survey	Estimated
2004	935	1,650	411	725
2005	679	1,314	426	793
2006	694	940	603	897
2007	916	1,218	489	650
2008	983	1,211	861	1,060
2009	858	1,322	748	1,152
2010	699	1,225	500	877
2011	770	1,114	460	666
2012	578	867	438	657
2013	586	1,036	466	824
2014	593	972	444	728
2015	675	1,110	624	1,026
2016	453	767	717	1,215
2017	542	1,033	717	1,366
2018	524	971	897	1,662
2019	440	751	943	1,610
2020	337	632	835	1,565

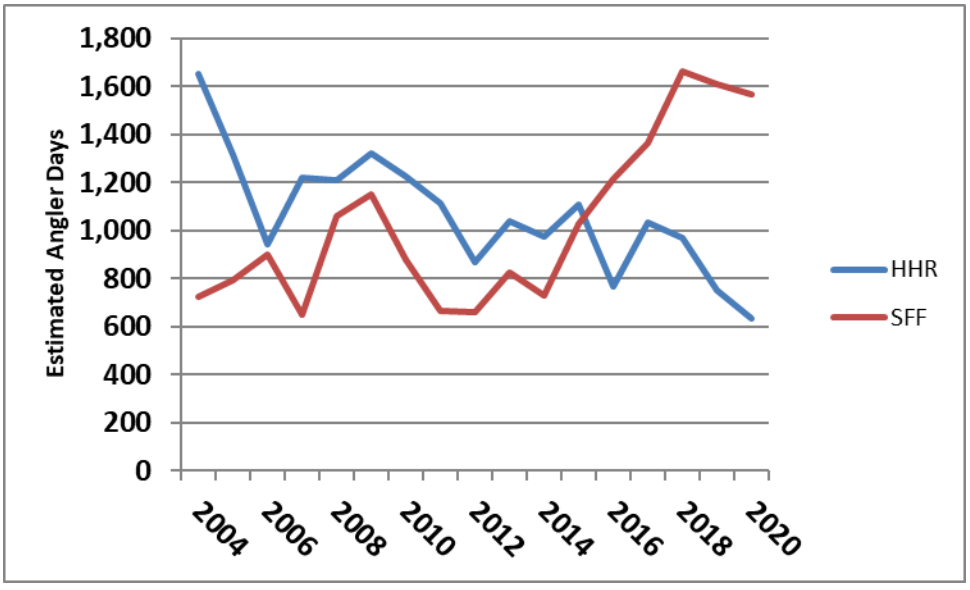

Figure 2: Estimated angler days for HHR and SFF 2004-2020.

Bull Trout Catch and Harvest Estimates

Bull trout anglers again reported catch and harvest by zone for HHR and SFF in 2019 and 2020 (Figures 3 and 4). Consistent with previous surveys, the majority of bull trout caught in HHR in May were caught in the southernmost zone (Zone C). This is likely due to bull trout staging and progressively moving upstream toward the river in preparation for spawning migration.

For the SFF, only catch and release fishing is allowed for bull trout (Figure 4). Consistent with most previous surveys, zone "D", the lowest and most accessible portion of the river, provided the greatest amount of catch in the SFF (64% for 2019-2020 combined). Similarly, catch increased into more remote areas of wilderness as the summer progressed. Unfortunately, anglers reported catching 11 bull trout (6 in 2019 and 5 in 2020) during months outside the permitted period. The anglers' names were passed on to law enforcement for fishing outside the season, though it is likely that several of the fish may have been caught inadvertently while fishing for cutthroat. Additionally, some anglers reported losing their catch cards and filled out the survey to the best of their ability based on memory of the season. In these cases, the actual dates reported may be inaccurate.

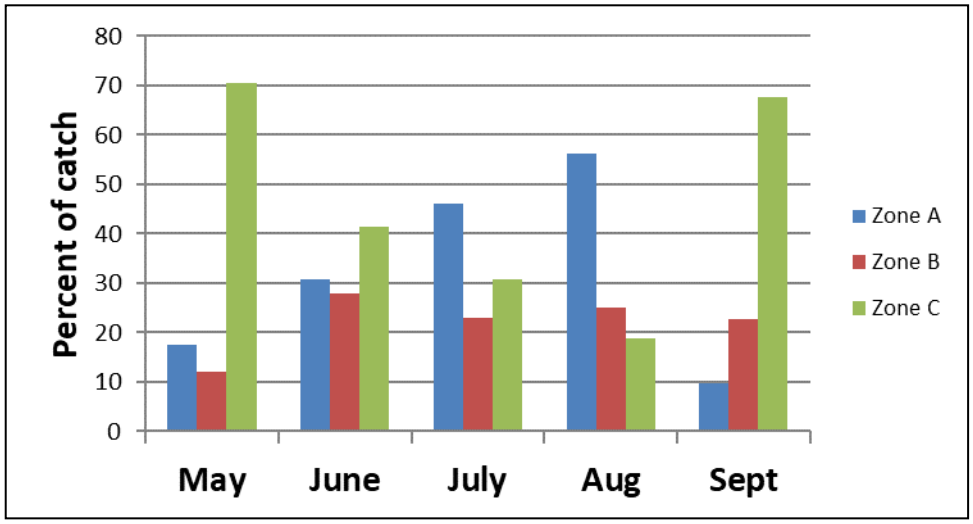

Figure 3: Hungry Horse Reservoir (HHR) bull trout catch by zone from the angler survey, 2019-2020. Zone A equals the northern portion of HHR, Zone B is central, and Zone C is the southern portion. Zones are mapped in the experimental bull trout fishery regulations and are described on the catch card.

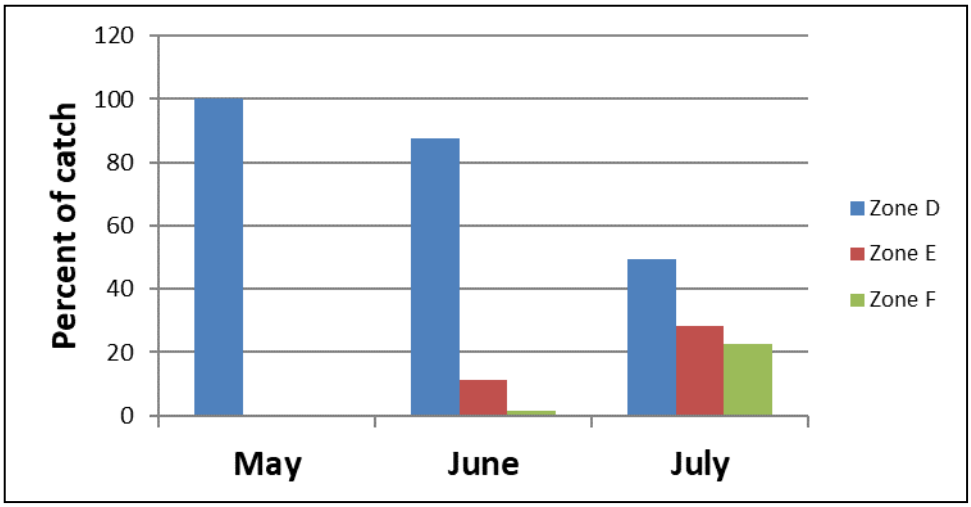

Figure 4: South Fork Flathead (SFF) bull trout catch by zone from the angler survey, 2019-2020. Zone D equals the northern portion of SFF, Zone E is central, and Zone F is the southern portion. Zones are mapped in the experimental bull trout fishery regulations and are described on the catch card.

Total catch and harvest estimates for HHR and SFF were calculated for non-respondent anglers. Catch from estimated pressure was added to catch reported from the angler survey, assuming equal catch rates (Hensler et al. 2005; Rumsey et al. 2005; Hensler and Benson 2006; Rosenthal and Hensler 2008; Rosenthal 2009; Rosenthal 2010; Rosenthal 2011; Rosenthal and Hawxhurst 2014; Rosenthal and Hawxhurst 2015; Rosenthal and Hawxhurst 2018; Rosenthal and Hawxhurst 2020) (Table 2). In 2019 an estimated 427 bull trout were caught in HHR and 351 were caught in 2020. This represented a considerable decrease when compared the previous report. This is likely a result of decreased estimated angler pressure in the reservoir. Estimated bull trout harvest for this reporting period was 46 bull trout in 2019 (11.0% of total) and 56 in 2020 (16% of total). While the estimated number of bull trout harvested in HHR is consistent with past surveys, the percentage of fish harvested in the reservoir did increase considerably. Though the level of bull trout harvest is still quite low, this finding suggests that anglers have shifted their catch and release fishing to the river and that the harvest-oriented anglers are more focused on fishing the reservoir. In the SFF, 323 bull trout were caught and released by surveyed individuals in 2019 and 233 were reported in 2020. Using the same approach to account for non-respondent anglers resulted in an estimated catch of 552 bull trout in 2019 and 437 bull trout in 2020 (Figure 5). The total catch and harvest estimates from 2006-2008 are likely more accurate than 2005 because we were able to better separate validations those years. However, they still should be viewed with some caution because they include validations for all three systems (HHR, SFF, and LK), and non-responding anglers may not have fished HHR/SFF. In contrast, estimates since 2009 more accurately represent true catch and harvest rates because anglers were forced to choose between the two drainages (HHR/SFF and LK). The estimated catch of 437 bull trout in SFF in 2020 represents a considerable decrease since the previous survey report, when estimated catch reached an all-time peak. While the 2020 estimated catch was lower, the recent 5-year average of 563 bull trout is still much higher than the period from 2011-2015 (265 bull trout). The recent trend in increasing catch in the SFF shows that anglers are focusing their

efforts on the river fishery and have become increasingly proficient at techniques to capture these large fish.

Table 2: Estimated bull trout catch and harvest for Hungry Horse Reservoir (HHR) through the 2020 season. The lower bound for these estimates represents the known catch and harvest from surveyed individuals.

Year	Est. Bull Trout Catch	Upper Bound (95% CI)	Lower Bound (Known)	Est. Bull Trout Harvest	Upper Bound (95% CI)	Lower Bound (Known)
2004	355	--	201	48	--	27
2005	2154	2167	778	58	59	44
2006	623	627	460	56	57	43
2007	533	535	402	57	57	44
2008	621	624	502	74	75	60
2009	832	839	540	97	98	63
2010	792	801	452	75	77	43
2011	870	881	601	56	57	39
2012	590	596	394	57	58	38
2013	348	352	197	42	43	24
2014	583	590	356	51	52	31
2015	390	394	237	36	37	22
2016	344	347	203	24	25	14
2017	770	784	404	44	45	23
2018	612	624	330	41	42	22
2019	427	430	250	46	47	27
2020	351	355	187	56	57	30

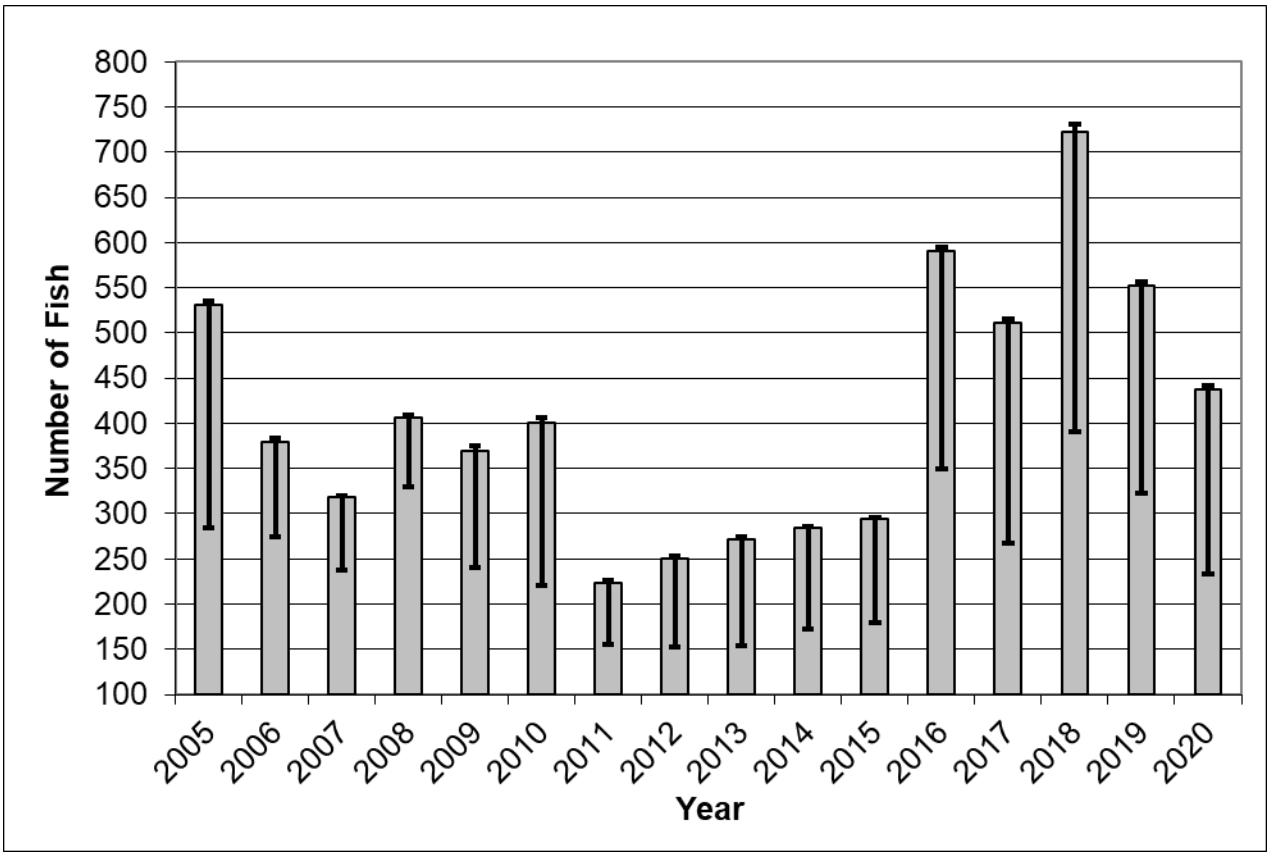

Figure 5: Estimated numbers of bull trout caught and released in the South Fork Flathead River (SFF) through the 2020 season. Error bars represent the 95% confidence intervals (upper bound) and the known bull trout catch from surveyed individuals (lower bound).

The catch cards and surveys require anglers to record lengths of bull trout caught by water body. Length frequency distributions for HHR (Figure 6) depict the size of bull trout harvested or released by anglers. The distribution of bull trout caught and released in HHR in 2019 and 2020 was similar to all previously surveyed seasons. Anglers continue to select larger bull trout for harvest in HHR. The distribution of bull trout caught and released from SFF has been similar through all years of the survey (Table 3).

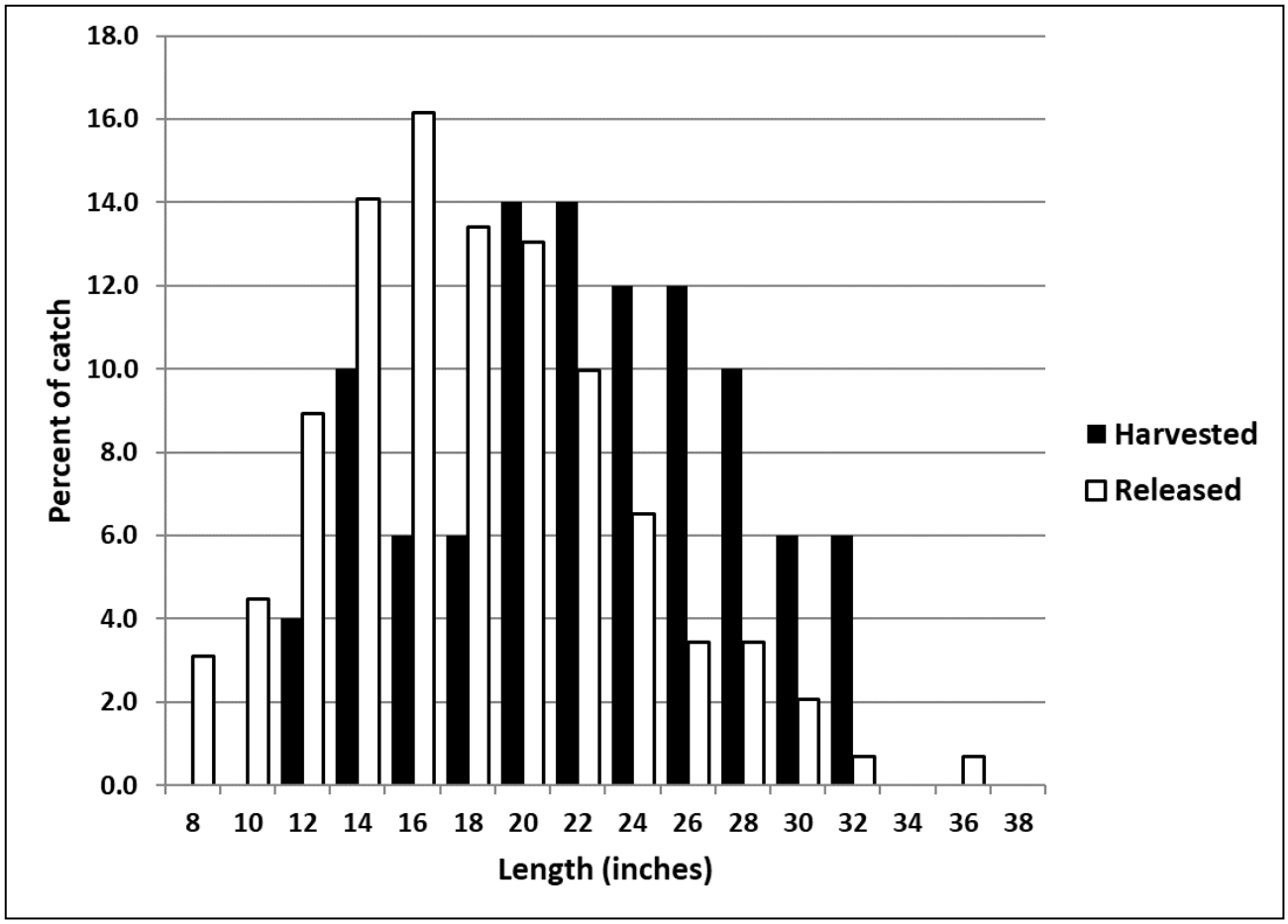

Figure 6: Length frequency histogram of bull trout harvested and released by percent for Hungry Horse Reservoir, 2019 and 2020 seasons.

Table 3: Lengths of caught and released bull trout from the South Fork Flathead River 2004-2020. Lengths are measured in inches.

Year	Minimum	Maximum	Mode	Mean	Standard Deviation
2004	10	38	20	23.75	5.91
2005	6	38	28	22.50	6.48
2006	8	40	18	21.43	6.18
2007	11	38	24	23.39	4.86
2008	9	36	28	22.49	6.71
2009	8	42	18	20.72	6.02
2010	6	36	22	20.75	5.63
2011	6	31	20	20.04	4.61
2012	8	35	18	21.18	6.16
2013	7	34	24	21.93	6.54
2014	9	34	18	20.33	5.50
2015	8	36	24	20.51	7.05
2016	6.5	35	18	21.13	5.66
2017	4	35	22	20.99	5.24
2018	8	37	22	21.58	5.32
2019	6	36	21	21.59	5.43
2020	4.5	37	18	21.87	5.92

DISCUSSION

The original provisions of the USFWS special permit authorized angler take of up to 300 bull trout per year from HHR and catch and release only in the SFF. Since the inception of the experimental fishery, the highest estimated harvest was 98 fish per year (2009). Additionally, conservative estimates for catch and release mortality (5.0%) still have not resulted in the fishery exceeding the 300-fish take limit. Using the recent 5-year average catch estimates (2016-2020) from the survey and a 5.0% mortality rate for post-release bull trout (~53 fish), combined with the estimated annual bull trout harvest over the same 5-year period (42 fish), reveals an estimated annual take of 95 fish from 2016-2020. This represents some of the highest estimated take since the inception of the permitted fishery, but is still below the predetermined take threshold.

The HHR/SFF bull trout population continues to be closely monitored and the current estimates of bull trout catch and harvest do not appear to be causing a negative impact. Adult bull trout abundance is monitored through annual fall redd counts. Bull trout redds are counted in four reservoir tributaries annually, and four wilderness tributaries periodically (every 3-5 years). These surveys have been conducted since 1993 but because of the remote nature of the upper SFF, total counts (all eight tributaries) have only been completed twelve times. The wilderness tributaries were last counted in 2019. A strong correlation exists between the number of redds counted in the reservoir tributaries and the total number of redds counted when all eight tributaries are surveyed (Figure 7). Because of this correlation, estimated total redd counts were calculated using the mean proportion (21.53%) of reservoir to total (wilderness and reservoir)

counts (Figure 8). These data (expanded from just the reservoir tributaries) should be viewed with some caution, as the majority of bull trout spawning occurs in the four wilderness streams. The 26-year dataset shows no trend with regard to the number of adult bull trout. More specifically, this stable trend is consistent throughout the time period in which the experimental fishery was occurring (2004-2021). Redd counts in 2021 show an increase compared to previous years. This is likely due to a high count in Sullivan Creek, which had reduced numbers until recently. While redd counts are primarily used to assess trends, biologists have often attempted to use redd numbers to estimate the number of bull trout in a population. Historic work in the Flathead system (Fraley and Shepard 1989) described the number of bull trout per redd (3.2) to assist in this type of data extrapolation. Similar studies have been conducted in other systems as well. To further this knowledge, FWP is currently working on a project in Wounded Buck Creek using underwater cameras to count the number of bull trout migrating into the system in the fall. Redds are counted several times throughout the spawning season to get accurate numbers. The information gained from this project will aid in future conversations regarding the overall number of bull trout and potential angling impacts.

In addition to redd counts, sub-adult and adult bull trout densities in Hungry Horse Reservoir are also monitored through semi-annual standardized gillnetting surveys (Figure 9). Netting surveys in 2011, 2013, and 2017 produced some of the lowest numbers of bull trout per net since the beginning of the experimental fishery. However, netting in 2015 and 2019 revealed bull trout catch-per-net numbers similar to the 30-year average of 6.9 bull trout per net, indicating a relatively stable trend. Additionally, the 2015 netting produced 9.1 bull trout per net, which was one of the highest years on record. This variability could be related to methodology of how the nets were set, though more data is needed to confirm this. Gill net monitoring of the bull trout population has recently been changed from biennial, to every 3-5 years to reduce bull trout mortality. Gill net monitoring is scheduled for fall of 2022.

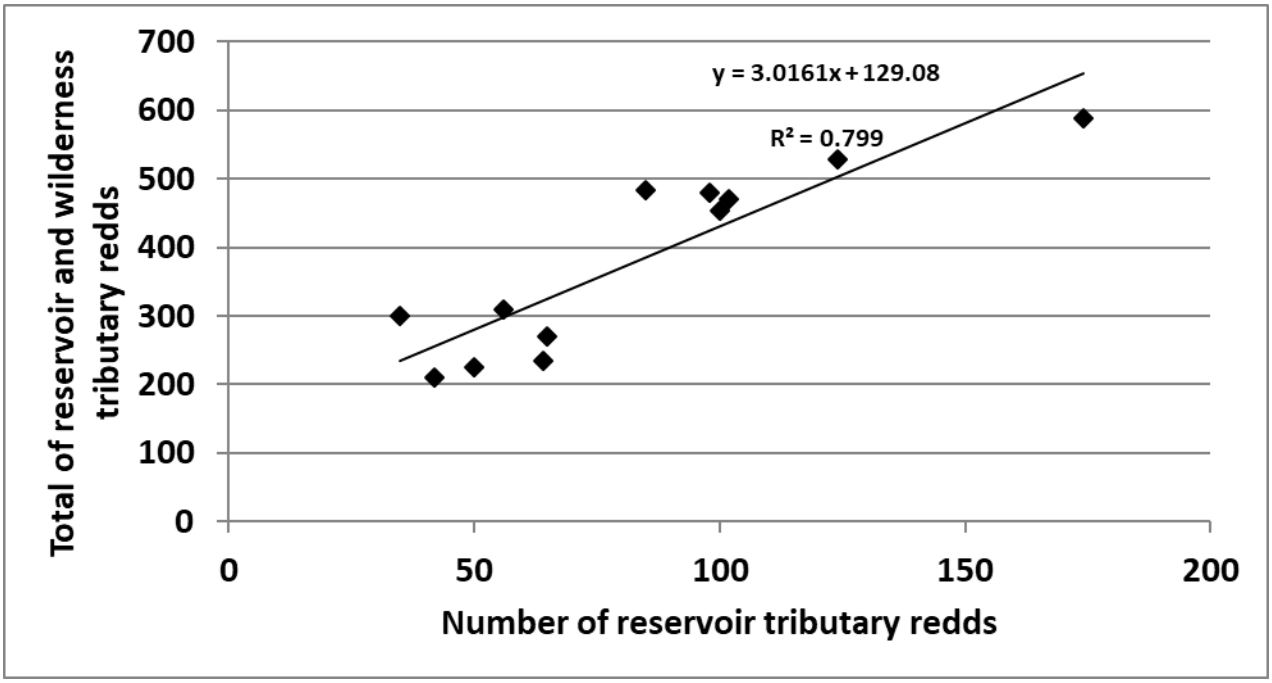

Figure 7: Correlation between bull trout redd counts in reservoir index tributaries and those in reservoir and wilderness tributaries for HHR/SFF 1993-2019.

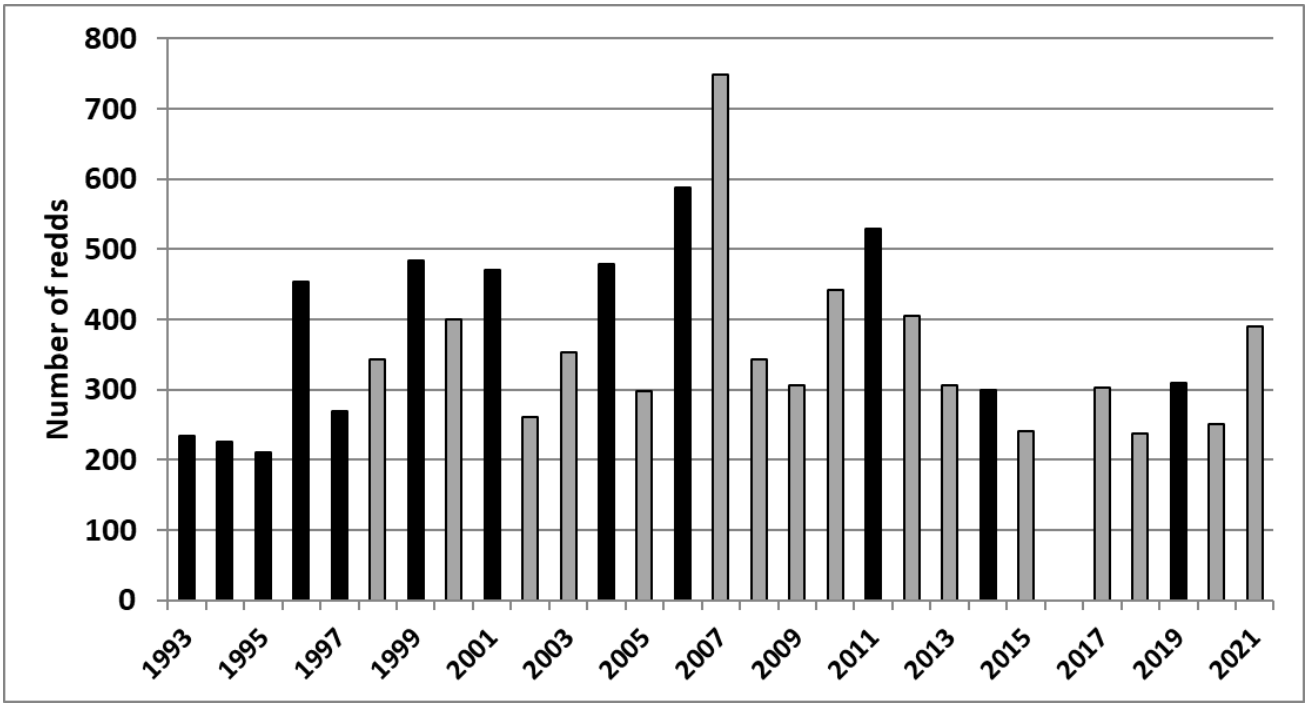

Figure 8: Bull trout redd counts for the HHR/SFF population through 2021. Black bars represent years in which wilderness and reservoir tributaries were surveyed. Gray bars represent years in which total redd counts were estimated, as only reservoir tributaries were surveyed.

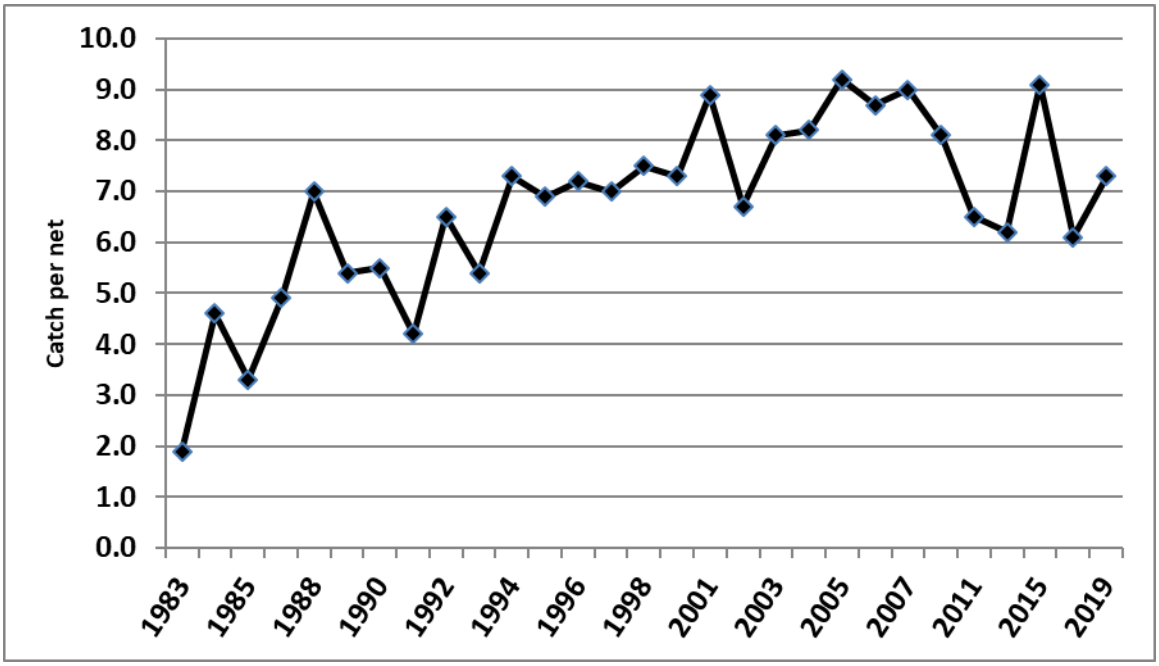

Figure 9: Bull trout catch per net during fall gillnetting surveys in Hungry Horse Reservoir 1983-2019.

Participation in the HHR/SFF bull trout fishery has increased over time. This has resulted in increased estimates of angling pressure as well as increased catch estimates but is not uniform with regard to each water body. Consistent with previous reports, estimated angler pressure in SFF continues to be higher than pressure in the reservoir. This change in angler use could be for several reasons. The first is the addition of Spotted Bear Ranger Station as a location anglers could obtain catch cards. Previously anglers were required to obtain their catch cards either by mail or from the FWP R-1 office in Kalispell. This additional location allowed anglers that had forgotten to acquire a catch card or were unable to come through Kalispell to obtain their permit. This would explain some of the increase in participation in an area that is typified by river anglers, though the trend had begun prior to greater accessibility of catch cards. Another explanation could be the result of increased popularity in packrafting or an increase in popularity of extended backpacking trips. Anecdotal information from backcountry users suggests that the wilderness portion of the SFF has seen more use in recent years. The US Forest Service monitors use of the Bob Marshall Wilderness and is currently updating their Wild and Scenic Comprehensive River Management Plan. The plan was last updated over 30 years ago. Monitoring associated with this plan will likely show that the perceived river use increase is actually occurring. Future catch card survey data will allow us to monitor this trend as well. Another potential reason for the increase is the rise in popularity of social media platforms like Facebook and Instagram. Many examples exist of anglers posing for photos with large bull trout against the beautiful clear waters of the SFF. These photos could encourage anglers to visit this area in pursuit of photos of their own.

While the bull trout fishery in the SFF/HHR appears to be sustainable at the current levels, the increase in participation, estimated pressure, and estimated catch does give some reason for concern. It is clear that more bull trout are being caught and released in the SFF than in previous years. Recent literature suggests that post-release mortality of large bull trout can be as high as

high as 15-33% in some streams because of anglers photographing memorable-sized fish (Joubert et al. 2020). A quick search of internet images suggests that anglers are routinely photographing SFF bull trout, and that our previous estimates of post-release mortality could be low if all large fish were subjected to photography. Concomitant with the increase in bull trout angling and catch rates, general angler pressure for the SFF is also increasing. This is evident from the rate of hook-scarring of westslope cutthroat trout in routine monitoring conducted by FWP. In response to this increase in angler pressure, FWP adopted a regulation change in 2020 prohibiting the use of treble hooks in the three forks of the Flathead River. This regulation change was adopted as a proactive measure to reduce catch-and-release handling time. The new regulation should benefit both bull trout and westslope cutthroat trout.

No changes to the catch card program will occur for the 2021/2022 seasons. Anglers will continue to be able to obtain catch cards at both the FWP office as well as the Spotted Bear Ranger Station. The angling season dates and number of fish allowed for harvest will also remain the same. Monitoring the abundance of bull trout in HHR and the SFF will continue in the same manner as previously conducted. Basin-wide bull trout redd count surveys were conducted in the fall of 2019, and are scheduled to occur again in 2023. Those results will be included in the next report. Reservoir tributary redd counts will continue to be conducted annually. As mentioned previously, gill net surveys have been modified to occur every 3-5 years. The fall netting survey will be completed in 2022 as a continuation of that data set. These data, in addition to all previous catch card surveys will inform managers whether changes are warranted to the program.

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